INTERNATIONAL FOOD INFORMATION SERVICE

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FAB 17

MICROBIAL TOXINS IN FOODS

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Coverage of the subject has been restricted to that of Food Science and Technology Abstracts, which covers over 1200 of the important food journals, patents from 20 countries and books published world-wide. Every effort is made to include all significant references, but editorial discretion is used on the many articles of borderline interest. If the reader particularly needs an exhaustive search of the subject, we will be pleased to provide any other references that we have available. We would, in any case, encourage readers to write or telephone us with any comments or queries that they may have.

H. BROOKES
ASSISTANT EDITOR

1

[Chromatographic purification of Clostridium botulinum serotype B toxin.] Erfahrungen bei der chromatographischen Reinigung von Clostridium botulinum Toxin des Serotyps B.
Remmers, J.
Archiv für Lebensmittelhygiene **28** (3) 86-90 (1977) [many ref. De, en] [Inst. für Lebensmittelkunde, Fleischhygiene & Tech. der Tierärztlichen Hochschule Hannover, Schlossplatz, 2960 Aurich, Federal Republic of Germany]

To produce a pure toxin for use in a rapid serological food examination method, C. botulinum type B toxin was purified by gel filtration and ion exchange chromatography. The neurotoxin obtained was pure and gave no cross reaction with type A antiserum. Its mol. wt. by Sephadex gel filtration was 140 000-150 000 and toxicity 3.2×10^7 min. lethal dose/mg protein. Greater yield of toxin was obtained with DEAE-Sephadex than with cellulose anion exchanger (62 vs. 35-38% recovery). RM

2

Comparative studies of Bacillus cereus strains isolated from various foods and food poisoning outbreaks.
Raevuori, M.; Kiutamo, T.; Niskanen, A.
Acta Veterinaria Scandinavica **18** (3) 397-407 (1977) [27 ref. En, sv] [State Vet. Med. Inst., PO Box 368, 00101 Helsinki 10, Finland]

Comparative studies were conducted on characteristics of a total of 22 strains of Bacillus cereus (5 from diarrhoeal-type food poisoning outbreaks, 5 from vomiting-type outbreaks, and 12 from other sources). Characteristics studied included metabolic and biochemical characteristics, sensitivity to antibiotics, fatty acid composition, and results of the rabbit skin test. Tables of results are given. The results show that strains causing diarrhoeal-type and vomiting-type food poisoning could not be differentiated on the basis of the characteristics studied. It is suggested that the food environment influences enterotoxin production by B. cereus. AJDW

3

Clostridium botulinum in irradiated fish. [Review]
Hobbs, G.
Food Irradiation Information No. 7, 39-54 (1977) [21 ref. En, fr] [Torry Res. Sta., MAFF, Aberdeen, UK]

This review considers the properties of Cl. botulinum and its toxin, radiation resistance of Cl. botulinum spores, factors governing growth and toxin production, incidence of Cl. botulinum in fishery products and the effects of radiation processing. Inoculated pack studies on a number of different fish and shellfish species and smoked fish showed that at storage temp. > 10°C but not at 5°C toxin usually accumulates before the end of the shelf-life. There was little difference in the rate of toxin production at contamination levels $\geq 10^2$ spores/g; below this level the rate was rapidly reduced. The growth of the organism and toxin production was greater in fatty fish (herring) than in non-fatty fish (cod, haddock) or some shellfish. In freshly caught fish with low levels of contamination, storage at 5° or 10°C results in spoilage long before toxin is detected, irrespective of irradiation. At higher storage temp., toxin was frequently detected before fish was rejected, especially in irradiated fish. No growth or toxin production was observed at < 3.8°C. The evidence presented showed no toxin production in low-count fishery products prior to the organoleptically objectionable stage. Doses of 100-130 krad resulted in increased chance of toxin accumulation before rejection only at higher storage temp. and contamination levels. A code of practice for radiation pasteurization could eliminate any botulism hazard. RM

4

[Clostridium perfringens as a cause of food poisoning.]
Fabiansson, S.; Normark, C.
Svensk Veterinartidning **28** (16) 687-698 (1976) [33 ref. Sv] [Inst. för Livsmedelshygien, Veterinärhögskolan, 104 05 Stockholm, Sweden]

Aspects covered in this discussion of food poisoning caused by Clostridium perfringens include: historical aspects; classification of Cl. perfringens; characteristics of Cl. perfringens types A and C; symptoms of food poisoning by Cl. perfringes; conditions required for growth of Cl. perfringens; enterotoxin formation; and isolation and identification of Cl. perfringens. AJDW

5

[Serological diagnosis of staphylococcal food poisoning.]
Pimenova, V. A.; Burgrova, V. I.
Voprosy Pitaniya No. 5, 93 (1977) [3 ref. Ru] [Kemerovskii Med. Inst., USSR]

Antiserum against enterotoxin type A was used to detect production of the enterotoxin in 90.9% of 33 strains of coagulase-positive staphylococci isolated from cheese which contained 45-20 000 staphylococci/g. Most (84.9%) of the strains were non-haemolytic, 75.8% had lecithinase activity, and 69.7% were phage type 6/47/54. ADL

6

[Staphylococcal food poisoning.]
Danielsson, M.-L.; Hansson, T.
Var Föda **29** (5) 191-196 (1977) [11 ref. Sv, en] [Inst. för Livsmedelshygien, Veterinärhögskolan, Stockholm, Sweden]

An outbreak of staphylococcal food poisoning at a school near Göteborg is described. The outbreak involved 28 of 46 people who had consumed a lunch comprising grilled 'Kassler' pork loin, mashed potatoes and mixed vegetables. Bacteriological investigations revealed the presence of coagulase-positive staphylococci (at counts > 300 000/g) in the pork loin; type A enterotoxin was also detected. The meat had been purchased (ready-grilled) the day before, and stored overnight in a refrigerator.

Investigations at the shop from which the pork loin was purchased showed throat and nose swabs from 3 employees (2 of whom worked in the grilling section) to be positive for coagulase-positive staphylococci forming type A enterotoxin. Diagnosis of staphylococcal food poisoning is briefly discussed, with special reference to the micro-slide double diffusion test for enterotoxins. AJDW

7

Correlation of enterotoxin and thermonuclease production with some physiological and biochemical properties of staphylococcal strains isolated from different sources.

Niskanen, A.; Koiranen, L.

Journal of Food Protection 40 (8) 543-548 (1977) [28 ref. En] [Food Res. Lab., Tech. Res. Cent., Biologinkuja 1, SF-02150 Espoo 15, Finland]

276 Staphylococcus aureus strains isolated from routine sampling, food poisoning outbreaks and mastitis milk were examined for production of enterotoxins A, B, C, D and E. Quantitative detn. of thermonuclease was carried out from the dialysis sac culture supernatant fluids obtained during the enterotoxin assay. The toxic properties of the strains were compared with other biochemical properties (coagulase, phosphatase, production of pigment, and haemotoxin) and with their sensitivity to antibiotics and phages. 51% of the strains examined produced enterotoxin, and of the toxigenic strains 53% produced enterotoxin A, 4% produced B, 38% C, and 20% D. Production of enterotoxin E was not observed with any of the strains. Production of thermonuclease averaged 19.4 and 25.5 µg/ml for toxigenic and non-toxigenic strains resp. All toxigenic strains produced coagulase, 98% produced phosphatase, 92% haemotoxin, and 79% yellow or orange pigment. Of the toxigenic strains isolated from food, 56% belonged to phage group III, and of the toxigenic strains isolated from mastitis cases 31.4% belonged to phage group M and 21% to phage group III. Resistance to antibiotics was slightly more widespread among the toxigenic than the non-toxigenic strains. AS

8

The occurrence of Clostridium botulinum type E in Finnish trout farms and the prevention of toxin formation in fresh-salted vacuum-packed trout fillets.

Ala-Huikku, K.; Nurmi, E.; Pajulahti, H.; Raevuori, M.

Nordisk Veterinaermedicin 29 (9) 386-391 (1977) [18 ref. En, sv] [State Vet. Med. Inst., PO Box 368, 00101 Helsinki 10, Finland]

The occurrence of C. botulinum on 2 Finnish rainbow trout farms was studied. C. botulinum type E toxin was detected from samples of fish intestines in 10% and 4% of samples and in 0% and 100% of dam bottom sediments, resp. for the 2 farms. The toxin formation of inoculated C. botulinum type E in 3 different brands of commercial fresh-salted vacuum-packed trout fillets was also investigated. In a brand with a salt concn. of 2.7% (water activity (a_w) = 0.96) and no nitrate, the toxin was formed in 2 wk at 10° and 20° C. At pH 4.90 and NaCl concn. of 5.67% (a_w = 0.94%) no toxin was formed, even without the use of nitrate. By adding 0.1% of $NaNO_3$ to the curing solution (0.046% nitrate in the product) the toxin formation was prevented at pH 5.40 in the presence of 2.70% NaCl. Trout products refrigerated at 5° C contained no detectable toxin. Trout products should be manufactured and stored in such a way as to eliminate toxin formation. AS

9

Rapid detection and quantitation of Clostridium perfringens enterotoxin by counterimmunoelectrophoresis.

Naik, H. S.; Duncan, C. L.

Applied and Environmental Microbiology 34 (2) 125-128 (1977) [13 ref. En] [Dep. of Food Microbiol. & Toxicol., Food Res. Inst., Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

For detection of C. perfringens enterotoxin, e.g. in foods, by counterimmunoelectrophoresis (CIEP), a glass slide is covered with a thin layer of 2% Ionagar in 0.025 ionic-strength barbital-acetate buffer (pH 8.6). After hardening this is layered with 15 ml of 0.6% agarose in the same buffer. C. perfringens purified enterotoxin is diluted in distilled water (pH 6.7), buffer or 0.85% saline and placed in wells near the cathode. Rabbit anti-enterotoxin is placed in wells near the anode. Electrophoresis is carried out at room temp. or 4° C, with constant current of 12 mA/slide for 30 min. Slides are then placed in a humidity chamber to develop for 5-10 min. A linear relationship was observed between concn. of enterotoxin and CIEP titre of toxin. For quantitation, 2-fold serial dilutions of enterotoxin in water (pH 6.7) were better than dilution in buffer or saline. No nonspecific reaction was observed with various controls including 0.85% NaCl, buffer, D-S sporulation medium or various food extracts (2 gravies and 5 moist-cooked meats). No difference was observed between results at 4° C and at room temp. Antiserum having a 1:4 titre was effective for enterotoxin detection. Detection limit for C. perfringens type A enterotoxin was 0.2 µg/ml or 0.002 µg on dry wt. basis. SP

10

Recovery of staphylococcal enterotoxins from foods by affinity chromatography. (In 'Proceedings of the 20th World Veterinary Congress' [see FSTA (1978) 10 3G126].) [Lecture]

Genigeorgis, C. A.; Kuo, J. K.

1, 807-808 (undated) [En] [Dep. of Epidemiology & Preventive Med., Vet. School, Univ. of California, Davis, California 95616, USA]

Studies on the use of affinity chromatography (using antibody coupled to an inert matrix) for isolation of staphylococcal enterotoxins from foods are described. Pure antienterotoxin B globulin was coupled to Sepharose 4B (generally 700 µg antibody/ml Sepharose) by the method of

Cuatrecasas & Anfinsen [Methods in Enzymology (1970) 22, 345]. When pure enterotoxin B was filtered through a Sepharose/antibody column, >96% of the enterotoxin was retained, and could subsequently be eluted with glycine buffer (pH 2.8). Recovery of enterotoxin from food extracts (containing as little as 0.001 μg enterotoxin/g) was >75%. No interference by other food constituents was observed. AJDW

11

[Effect of mastitis induced by staphylococcal enterotoxin on fatty acid composition of cows' milk fat.]

Santos, E. C. dos; Moreira, H. A.

Arquivos da Escola de Veterinaria, Universidade Federal de Minas Gerais **29** (2) 129-135 (1977) [10 ref. Pt, en]

Left forequarters of cows were injected by intramammary infusion with 2 mg staphylococcal toxin. Milk samples collected from normal quarters and from injected quarters both before and 3, 6, 9, 24, 48 and 96 h after injection were analysed for fatty acid composition. The differences in fatty acid composition between normal and injected quarters were significant in certain cases, but difficult to interpret. In the case of oleic acid, for example, there were significant differences after 48 and 96 h, but not after other periods. In milk from both normal and injected quarters, oleic, linoleic and linolenic acids were found in smaller amounts (as % of total fatty acids) after 48 h than at other periods, the decrease being more marked in the case of the injected quarters. A similar trend was observed for hexadecenoic acid in milk from injected quarters, but after 96 h the proportion of this acid was virtually identical in milk from normal and injected quarters. ADL

12

Potential for growth of enterotoxigenic staphylococci in Cheddar cheese whey.

Miller, J. S.; Ledford, R. A.

Journal of Dairy Science **60** (11) 1689-1692 (1977) [10 ref. En] [Dep. of Food Sci., Cornell Univ., Ithaca, New York 14853, USA]

Cheddar cheese whey direct from the vat did not support growth of enterotoxigenic strains of Staphylococcus aureus. Loss of viability was directly proportional to incubation temp. and was apparently caused by growth of lactic acid bacteria, since Staph. aureus grew well in filter-sterilized whey and in heat-treated (62°C for 30 min) whey adjusted to pH 6.8. After incubation for 24 h at 37°C in heated whey (when the Staph. aureus counts on Baird-parker medium were 1.7×10^6/ml) some heat-stable nuclease activity was observed, but no enterotoxin A was detected by the capillary tube gel-diffusion technique. It is suggested that special precautions should be taken to avoid contamination with staphylococci after heat-treatment of whey. MEG

13

Staphylococcal enterotoxin production in Greek dry sausage "Karamanlidika". (In 'Proceedings of the 20th World Veterinary Congress' [see FSTA (1978) 10 3G126].) [Lecture]

Karaioanoglou, P. G.; Mantis, A. I.; Voyiazas, D. S.; Koidis, P. A.

1, 809-811 (undated) [4 ref. En] [Dep. of Food Hygiene, Vet. Fac., Univ. of Thessaloniki, Greece]

Studies on growth and toxin formation by Staphylococcus aureus strain S-6 in artificially inoculated 'Karamanlidika' dry sausages are described. The sausage meat was inoculated (just before filling the casings) with S. aureus at a count of 15×10^4-11×10^6/g. The sausages were then stored at room temp. for ≤21 days. At intervals, composition and microbiological quality were evaluated. A table and a graph of results are given. The results show that counts of S. aureus increased during the first 24 h of storage, then decreased considerably. Enterotoxin formation was observed only in samples in which a high S. aureus inoculum was used. Count of lactic acid bacteria and total acidity increased during storage; pH and water activity decreased. AJDW

14

[Botulism in some yearlings.]

Gruys, E.; Binkhorst, G. J.; Bercken, J. van den; Meijers, P.; Haagsma, J.

Tijdschrift voor Diergeneeskunde **102** (16) 983-988 (1977) [8 ref. Nl, en] [Fac. der Diergeneeskunde, Utrecht, Netherlands]

Of 3 beef yearlings infected with Clostridium botulinum, type C toxin was detected in the sera of animals 1 and 2 and in the liver and abomasum contents of animal 1. The organism was isolated from the liver of animal 1. Implications for meat inspection are briefly discussed. RM

15

[Sterilized and pasteurized food preserves. Microbiological analytical methods: determination of Clostridium botulinum and botulism toxins.]

Bulgaria, D"rzhaven Komitet za Standartizatsiya

Bulgarian Standard **BDS 13806-76**, 10pp. (1977) [Bg]

16

Poisonous or deleterious substances in food.

United States of America, Food & Drug Administration

Federal Register **42** (190, Sept. 30) 52814-52824 (1977) [En] [Washington, DC, USA]

Procedures are established for regulating food contaminants and naturally occurring poisonous and deleterious substances in food, under the Federal Food, Drug, and Cosmetic Act. A naturally occurring poisonous or deleterious substance is one that is an inherent natural constituent and is not the result of environmental, agricultural, industrial, or other contamination. An added poisonous or

deleterious substance is one that is not naturally occurring or is a naturally occurring one the level of which has been increased to abnormal levels through mishandling or other intervening acts. CAS

17

[Food microbiology in historical perspective: progress in bacteriology, mycology, virology and parasitology for better consumer protection.] [Review]
Mossel, D. A. A.
Cahiers de Nutrition et de Dietetique 12 (3) 181-191 (1977) [105 ref. Fr] [Microbiol. Med. des Aliments, Univ. d'Utrecht, Utrecht, Netherlands]

Public health statistics on the incidence of microbial food poisoning are considered to be inadequate. Of 100 persons infected by a toxic agent, adequate information reaches a health authority from only 5. Original infection can be spread over wide areas, e.g. from 'carrier' operatives, holiday centres and airline meals. Immediate toxicology is usually well known together with treatment giving rapid relief of symptoms; emphasis is placed on increasing evidence of clinical symptoms building up from a minor gastroenteritis disturbance, against which the public is inadequately protected (detailed examples are given). Consumer protection by 'repressive control' based on sampling/analysis is unsatisfactory and impracticable; protection must be obtained by good manufacturing practice (GMP) in the food industry at all stages from raw material to consumer. Special attention is required to prevent contamination (high risk from raw meat, poultry, cooked food, and utensils) and proliferation (usually from a high temp. gap in the cold chain). Simple self assessment for small factory and restaurant hygiene based on media-coated strips is described. GMP may be verified (not attained) by periodic microbiological analysis using standards based on GMP performance of good establishments. ELC

18

Factors affecting quantification of Clostridium perfringens alpha toxin by the hemolysin indicator plate test and other procedures.
Park, Y.; Mikolajcik, E. M.
Journal of Food Protection 40 (9) 626-631 (1977) [13 ref. En] [Dep. of Food Sci. & Nutr., Ohio Agric. Res. & Development Cent., Columbus, Ohio 43210, USA]

Comparison of electroimmunodiffusion on cellulose acetate, radial immunodiffusion, lecithovitellin agar plate, and haemolysin indicator plate for quantification of alpha toxin of C. perfringens revealed that the haemolysin indicator plate method was the most sensitive, detecting 0.0003 unit/ml. This sensitivity of the haemolysin indicator plate method was obtained when alpha toxin was diluted with Brewer Thioglycollate medium (Difco, 0236); with physiological saline solution, the method only detected 0.02 unit/ml. The proteose-peptone ingredient of Thioglycollate medium was the major contributor to increased sensitivity. Less refined agar yielded a larger haemolytic zone. This was attributed, in part, to its higher Ca content. The reducing agent, sodium thioglycollate, diminished the haemolytic zone. In terms of clarity of haemolytic zone, the optimum human red red blood cell concn. was 2.1×10^6/ml of base agar. Incubation of haemolytic indicator plates at 35°' rather than 21° or 45°C yielded greater haemolytic zones. When incubation time was extended, haemolytic zones also increased in size. AS

19

Food surveillance and food safety. [Lecture]
Elton, G. A. H.
Proceedings of the Nutrition Society 36 (1) 113-119 (1977) [11 ref. En] [Min. of Agric., Fisheries & Food, Horseferry Road, London SW1P 2AE, UK]

Surveillance of foods in the UK to detect chemical and microbial contamination is discussed. When investigating any given contaminant the probable intake from food is estimated, foods particularly at risk are identified, special groups of consumers at risk are identified and the possible toxicity of the contaminant is estimated. An example of this approach is given for Pb contamination. 9 groups of foods were analysed (cereals, meat, fish, fats & oils, fruit & preserves, root vegetables, green vegetables, milk and beverages) and it was found that canned baby foods averaged 0.24 mg Pb/kg compared to the average national diet content of 0.13 mg/kg. Steps were then taken to reduce Pb in canned baby foods, and when next measured Pb levels were 0.07 mg/kg. Other contaminants discussed include various other heavy metals, and nitrosamines. Salmonella is identified as the major cause of microbial food poisoning. Toxins in foodstuffs are discussed, especially aflatoxins in groundnuts. Imports are surveyed and sub-standard batches are condemned. [See FSTA (1978) **10** 4C105.] DIH

20

Bacterial hazards. [Lecture]
Gilbert, R. J.; Roberts, D.
Proceedings of the Nutrition Society 36 (1) 97-100 (1977) [15 ref. En] [Food Hygiene Lab., Cent. Public Health Lab., Colindale Avenue, London NW9 5HT, UK]

Characteristics of bacterial food poisoning in the UK are briefly discussed; 8000-12 000 cases of food poisoning are notified each yr. 70-80% are a result of Salmonella infections, especially S. typhimurium. Salmonella outbreaks are associated with meat, poultry and unpasteurized milk, all usually contaminated at source. Cross-contamination between raw and cooked food is seen as a major source of infection. The incubation period, duration and symptoms of infections,

qualitative heat resistance and foods most frequently implicated are tabulated for Salmonella, Staphylococcus aureus, Clostridium welchii, C. botulinum, Vibrio parahaemolyticus, Bacillus cereus and Escherichia coli. [See FSTA (1978) 10 4C105.] DIH

21

Naturally occurring toxins in foods. [Lecture]
Morton, I. D.
Proceedings of the Nutrition Society 36 (1) 101-105 (1977) [13 ref. En] [Dep. of Food Sci., Queen Elizabeth Coll., London W8 7AH, UK]

The toxic materials found in foods are briefly reviewed under 4 headings: (i) simple compounds present in foods; (ii) compounds removed during processing; (iii) compounds formed during processing; and (iv) compounds which are not removed during processing. (i) includes essential oils, many of which are toxic, goitrogens found in Brassica and Cruciferae spp. and nitrates in drinking water. (ii) includes soybean lectins, trypsin inhibitors in milk and eggs, and mycotoxins in cereals and nuts. (iii) includes nitrosamines and certain polymeric compounds and cyclic fatty acids which are formed on heating of frying oils. (iv) includes various toxins in marine organisms, especially botulinum toxin type E; heavy metals are also included in this category of toxic compounds. [See FSTA (1978) 10 4C105.] DIH

22

Presumed staphylococcal food poisoning associated with whipped butter.
Anon.
Journal of Food Protection 40 (10) 708 (1977) [En]

Whipped butter produced by the Sugar Creek Division of Beatrice Foods Co. on 28th and 30th June has been implicated in a multi-state outbreak of food poisoning which began the last wk of July. Symptoms of the illness were compatible with staphylococcal food poisoning. On 4th Aug. the manufacturer closed the plant and voluntarily recalled all whipped butter produced before then. Staphylococcus aureus organisms at up to 10^7/g were isolated from butter produced between 28th June and 3rd Aug., but butter produced on 21st June showed no growth of the organism. DMK

23

Comparison of toxin production by Clostridium botulinum type E in irradiated and unirradiated vacuum-packed trout (Salmo gairdneri).
Hussain, A. M.; Ehlermann, D.; Dichl, J.-F.
Archiv für Lebensmittelhygiene 28 (1) 23-27 (1977) [49 ref. En, de] [Bundesforschungsanstalt für Ernährung, Engesserstrasse 20, 7500 Karlsruhe, Federal Republic of Germany]

Fresh rainbow trout were slaughtered, gutted, cut into 100 g samples, inoculated with 10^1, 10^3 or 10^5 spores of Clostridium botulinum type E/g, vacuum-packed in polyethylene pouches, irradiated with 0, 100 or 200 krad and stored under melting ice (0° C), at 5° or 10° C for ⩽8 wk. Samples were examined weekly for sensory spoilage (smell) and toxin production; results are shown graphically. Only at 10° C did toxin production anticipate sensory spoilage in the irradiated samples (i.e. start of toxin production at 2 wk and sensory spoilage at 3 wk after 200 krad, after 1 wk and 2 wk, resp., after 100 krad, 5 wk and 1 wk in unirradiated samples). At 5° C storage temp., toxin production started at 7 wk and sensory spoilage at 4 wk after 200 krad, 6 wk and 3 wk after 100 krad. At 0° C no toxin production was observed. It was concluded that radurization of fish at 100 or 200 krad and storage at 0° and 5° C prevented possible botulism risk. RM

24

A study of coagulase-positive staphylococci in salami before fermentation.
Pullen, M. M.; Genigeorgis, C. A.
Journal of Food Protection 40 (10) 704-708 (1977) [20 ref. En] [Dep. of Large Anim. Clinical Sci., Coll. of Vet. Med., Univ. of Minnesota, St. Paul, Minnesota 55108, USA]

36 samples of salami formulation were examined for coagulase-positive (CP) staphylococci. A statistical analysis (Analysis of Covariance) was also performed to evaluate 6 variables and their effects on the dependent variable Y (number of CP staphylococci/g). The 6 variables evaluated were; certification vs. non-certification, daily sample order, proportion of meat (pork shoulders, pork jowls and beef), and total plate count. The average CP staphylococcal count was determined to be 3400/g (range 225-17000). Of the determinable variables, only certification (average 500 CP staphylococci/g) vs. non-certification (average 2100 CP staphylococci/g) was statistically significant. The additional freezing at -24° C for 10 days for trichina certification appeared to reduce the number of viable staphylococci. AS

25

[Detection of staphylococcal enterotoxin B by means of the ELISA-test.] Nachweis von Staphylokokken Enterotoxin B mittels ELISA-Test.
Simon, E.; Terplan, G.
Zentralblatt für Veterinärmedizin, B 24 (10) 842-844 (1977) [5 ref. De, en] [Inst. für Hygiene & Tech. der Lebensmittel Tierischen Ursprungs, Univ. München, Munich, Federal Republic of Germany]

The ELISA-test described enables the detection of enterotoxin B in a concn of 0.1-1 ng/ml in toxin solutions and in food extracts within a short time (reaction without measurement 1 h). Non-specific reactions with proteins or solvents have not so far been observed. AS

26

[Coagulase-positive staphylococci in Herve cheese.]
Waes, G.
Revue de l'Agriculture 30 (3) 617-628 (1977)

[13 ref. Fr, en] [Sta. Laitiere de l'Etat, Brusselsesteenweg 370, 9230 Melle, Belgium]

The growth of coagulase-positive staphylococci during manufacture of Herve cheese from raw milk, and their disappearance during ripening were investigated in model trials. A high bacterial count in the raw milk and rapid pH drop during manufacture usually, though not always, effectively inhibited the growth of staphylococci. Some of the Staphylococcus aureus present died during ripening: a 10-50-fold reduction was observed after 7 wk ripening. 70% of 10 Herve cheeses manufactured from raw milk, and 32% of 34 cheeses from retail outlets (part of which may have been produced from pasteurized milk) contained low numbers of coagulase-positive staphylococci. To reduce the risk of pathogens in cheese made from raw milk, the use of starter cultures is recommended. AS

27

Statistical analysis and quality control in radioimmunoassays for staphylococcal enterotoxins A, B, and C.

Orth, D. S.

Applied and Environmental Microbiology 34 (6) 710-714 (1977) [14 ref. En] [Procter & Gamble Co., Winton Hill Tech. Cent., Cincinnati, Ohio 45224, USA]

The objective of these studies was to set up a reliable radioimmunoassay (RIA) for staphylococcal enterotoxins A, B, and C (SEA, SEB and SEC) in a food system. Significant differences (95% confidence limits) were obtained between the 0- and 1-ng/ml enterotoxin standards, so the sensitivity of the RIAs was 1 ng/ml. Polystyrene tubes coated with anti-SEB and stored at 4° C were unstable. The % of iodinated SEB bound to these tubes decreased at a rate of 0.33%/day, in contrast to the rate of 0.07%/day obtained with tubes prepared the day before the analyses. Satisfactory precision and max. sensitivity were obtained by using 6 replicates for each sample and freshly coated tubes. The antisera used for coating the tubes were reused 4 times and were frozen between coatings. The process of drum drying mashed potatoes containing 1 μg SEB/g of mashed potatoes inactivated 83% (wt./wt.) of the SEB. Statistical quality control parameters were used to insure that RIAs were performing reliably with a sensitivity of 1 ng/ml. Over 450 samples of potato flakes and granules, which represented different production lots from 12 different manufacturers, were examined for SEA, SEB and SEC. No enterotoxins were detected. AS

28

[Enterotoxin production by Clostridium perfringens which caused food poisoning.]

Gyobu, Y.

Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] 18 (4) 375-381 (1977) [25 ref. Ja, en] [Toyama Inst. Health, Otemachi, Toyama, Japan]

For detection of C. perfringens which might produce enterotoxin, the micro cell culture technique was a convenient system for the screening test. It used serial dilutions of 45 h culture supernatant of GK medium inoculated with heat-treated thioglycollate culture and VERO cell suspensions. The characteristics of enterotoxin-producing strains were also investigated. TM

29

[Resistance to antibacterial agents of strains of enterotoxigenic staphylococci from foods and food-handling personnel.]

Fenicia, L.; Pasolini, B.

Rivista della Societa Italiana di Scienza dell'Alimentazione 6 (6) 479-482 (1977) [18 ref. It, en] [Istituto Superiore di Sanita, Rome, Italy]

Studies were conducted on the enterotoxin-forming capacity and the antibiotic-resistance of isolates of Staphylococcus aureus from 265 samples of foods implicated in outbreaks of food poisoning, and from 300 nasal swabs from food handling personnel. The results show that 205 (77%) isolates from foods implicated in food poisoning were toxigenic. 150 (50%) of nasal swab samples were positive for Staph. aureus; of these, 21 (14%) were toxigenic. The resistance of the 226 enterotoxigenic isolates to 25 antibacterial agents were studied; a block diagram of results is described. The results show that all strains studied were resistant to colimycin; high proportions ($\geqslant 50\%$) were resistant to penicillin, nalixidic acid, ampicillin and oxacillin. None were resistant to novobiocin or nitrofurantoin, and few ($\leqslant 10\%$) were resistant to erythromycin, chloramphenicol, lincomycin, kanamycin, rifamycin SV, rifampicin or triacetyl oleandomycin. AJDW

30

Double-antibody solid-phase enzyme immunoassay for the detection of staphylococcal enterotoxin A.

Saunders, G. C.; Bartlett, M. L.

Applied and Environmental Microbiology 34 (5) 518-522 (1977) [16 ref. En] [Los Alamos Sci. Lab., Univ. of California, Los Alamos, New Mexico 87545, USA]

A simple double-antibody enzyme immunoassay technique for detecting staphylococcal enterotoxin A (SEA) in foods is described. Samples of whole milk were prepared for analysis by adjusting the pH to 8.0 and adding Tween 80 to give a final concn of 0.25%. Samples of mayonnaise or hot dog were homogenized in normal saline (containing 0.5% Tween 80) at a rate of 1 ml saline/g sample, and the extract adjusted to pH 8.0 before adding to the anti-staphylococcal γ-globulin-sensitized microplates. Assay sensitivity ranged from 0.4 ng SEA/ml extract with a 20 h test period to 3.2 ng/ml with a 1-3 h test period. Recovery of enterotoxin from mayonnaise or hot dogs spiked with SEA ranged from 72 to 98%. MEG

31

[Conditions and time of enterotoxin type A formation in confectioner's cream products.]

Bugrova, V. I.; Fedorova, T. M.

Voprosy Pitaniya No. 1, 81-85 (1978) [5 ref. Ru] [Inst. Pitaniya AMN SSR, Moscow, USSR]

The semi-manufactured product Krem 21a (a 'Charlotte base' confectioner's cream with 59 ± 3% sugar) was studied to determine the conditions under which staphylococcal growth and enterotoxin formation could be expected. 50-g samples were inoculated with either 5×10^3 or 10^6 cells of laboratory culture Staphylococcus No. 3278 (a known producer of enterotoxin type A) and incubated at 25° or 37° C for ≤4 days. Tests were repeated with cream-filled cake cases which were first treated with 50% sugar syrup as a wetting agent (in accordance with the standard manufacturing procedure). The staphylococci grew well at 37° C in Krem 21a, reaching a max. after 24 h regardless of the dose; no enterotoxin was formed. The same occurred with the cake cases first treated with sugar syrup. In the controls (cream-filled cake cases not treated with sugar syrup, i.e. not in accordance with the recommended procedure), enterotoxin formed at 37° C after 6 or 8 h, depending on the size of the inoculum; formation required 10 or 12 h at 25° C. It is concluded that in bacteriological tests on confectioner's cream, the relevant pastry 'base' should also be included in the analyses. HBr

32

Growth and enterotoxin A production by Staphylococcus aureus in fluid dairy products.

Ikram, M.; Luedecke, L. O.

Journal of Food Protection 40 (11) 769-771 (1977) [11 ref. En] [Dep. of Food Sci. & Tech., Washington State Univ., Pullman, Washington 99164, USA]

Staph. aureus strain 100 grew better in skim-milk and whole milk (3.5% fat) than in half and half (10.5%) and whipping cream (30% fat) at 37° C. Enterotoxin A production was 1.14, 0.88, 0.24 and 0.18 µg/100 g skim-milk, whole milk, half and half, and cream, resp. Sufficient cell numbers were not obtained for enterotoxin production after 16 h at 22° C in these same media. AS

33

[Detection of Clostridium botulinum spores in fish and other sea-foods.]

Matsushita, Y.; Yokoseki, M.; Sasajima, M.; Kimie, A.

Bulletin of the Tokai Regional Fisheries Research Laboratory [Tokai-ku Suisan Kenkyusho Kenkyu Hokoku] No. 86, 41-50 (1976) [7 ref. Ja, en]

Studies on methods for detection of Clostridium botulinum spores in fish or other marine products are described. Conclusions include the following: cooked meat is the most suitable test substrate; removal of non-spore-forming bacteria by heating does not enhance toxin formation by C. botulinum; and the culture period required for development of max. toxicity is approx. 5 days for Cl. botulinum type E. Addition of frozen surimi made from walleye pollack (Theragra chalcogramma) sometimes inhibited toxin formation by C. botulinum; differences in inhibitory activity between different types of surimi may be attributable to differences in additives used. AJDW

34

Biochemical characteristics and enterotoxigenicity of Staphylococcus aureus strains isolated from poultry.

Gibbs, P. A.; Patterson, J. T.; Harvey, J.

Journal of Applied Bacteriology 44 (1) 57-74 (1978) [44 ref. En] [Dep. of Agric. for N. Ireland, Queen's Univ. of Belfast, Belfast, UK]

The incidence of Staphylococcus aureus on poultry carcasses in 6 different poultry processing plants over a period of 3 yr was studied. Sources of strains and phage typing were established by biochemical tests (coagulase test, haemolysin production etc.). Results showed end-of-lay hen carcasses generally carried larger numbers of Staph. aureus than broiler carcasses. About half (49%) of the strains of Staph. aureus isolated from poultry were non-typable with the international human set of phages; 55% were biotype B, according to the biochemical identification scheme of Hajek and Marsalek [Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene 1 Abteilung Originale Reihe (1973) A223, 176-182]. A furthest neighbour clustering strategy and principal coordinate analysis based on 17 biochemical tests made clear distinctions between biotype B strains and a group of biotype A and intermediate strains. Overall, 62% of strains were enterotoxigenic, the majority producing enterotoxin A. Starch gel zymograms of intracellular esterases showed a general correlation with the biotyping and phage typing results. It was suggested that live birds were probably the major source of non-typable strains within the plant and on the carcasses, although some human types were contributed during processing from slaughtermen (hands and knives), scald water, post plucking inspectors' hands, and before evisceration, flail washer and inspection. SP

35

[Application of electroimmunodiffusion to detection of staphylococcal enterotoxin B in foods.]

Pedretti, C.; Cicognani, G.; Vertemati, R.; Caserio, G.

Industrie Alimentari 16 (9) 125-131 (1977) [24 ref. It, en] [Istituto Ispezione degli Alimenti di Origine Animale, Univ. di Milano, Milan, Italy]

Detection of staphylococcal enterotoxin B in foods by Laurell's electroimmunodiffusion method [see Analytical Biochemistry (1966) 15, 45-52] is described; the method is based on electrophoresis in agarose gel, using barbiturate buffer (pH 7.4) and rabbit antiserum. The length of the precipitin-pattern cone formed is proportional to the concn. of

enterotoxin present. Development of reference curves using pure enterotoxin is described. A brief account is given of studies using whole milk and frozen beef containing, resp., 0.25 and 0.5 μg added enterotoxin B. Advantages claimed for this technique include rapidity, sensitivity, potential for semi-quantitative analysis, and simplification of the purification procedures required. AJDW

36

Purification and activity of Clostridium perfringens alpha toxin.

Park, Y.; Babajimopoulus, M.; Mikolajcik, E. M.

Journal of Food Protection 40 (12) 831-834 (1977) [17 ref. En] [Dep. of Food Sci. & Nutr., Ohio Agric. Res. & Developement Cent., Columbus, Ohio 43210, USA]

37

Standardized assay for Clostridium botulinum toxins.

Schantz, E. J.; Kautter, D. A.

Journal of the Association of Official Analytical Chemists 61 (1) 96-99 (1978) [3 ref. En] [Dep. of Food Microbiol. & Toxicology, Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

To improve the accuracy and precision of the mouse assay for botulinum toxins found in foods and body fluids, a stable reference standard of botulinum toxin was developed. It contains 100 ng crystalline type A botulinum toxin/ml 0.05M pH 4.2 sodium acetate buffer which contains 3 mg bovine serum albumin and 2 mg gelatin/ml. The albumin and gelatin stabilize the toxin. For distribution to laboratories carrying out the assay, 0.5 ml of the standard is sealed in 1 ml glass vials. The standard reference toxin, used as directed, enables the assayer to establish the response of laboratory mice, under a specific set of conditions, to a definite amount of toxin and to express the toxin content of an unknown in terms of ng toxin/g or ml food or body fluid. The mouse assay by itself is not specific for botulinum toxin, but when used in conjunction with specific antisera for identification and typing, it is the most reliable test available. AS

38

Nitrite additives - harmful or necessary? [Review]

Ravesi, E. M.

Marine Fisheries Review, National Oceanic and Atmospheric Administration 38 (4) 24-30 (1976) [40 ref. En] [Northeast Utilization Res. Cent., Nat. Marine Fisheries Service, NOAA, Emerson Avenue, PO Box 61, Gloucester, Massachusetts 01930, USA]

The question of whether the continued use of nitrites in the preparation of smoke-cured fishery products and processed meat products is necessary for the production of a product safe from deadly bacterial toxin (responsible for outbreaks of botulism) or whether their presence is responsible for the occurrence and formation of highly potent carcinogens in foods and/or the bodies of consumers is reviewed and discussed. AL

39

Detection of Salmonella enterotoxin using rabbit ileal loops.

Sedlock, D. M.; Deibel, R. H.

Canadian Journal of Microbiology 24 (3) 268-273 (1978) [22 ref. En, fr] [Dep. of Bacteriol., Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

The presence of an enterotoxin produced by Salmonella in broth culture has been demonstrated by using the rabbit ileal loop model. Response by the animal to enterotoxin in sterile culture supernatant fluids is enhanced when the intestinal lumen is washed with a mucolytic agent (modified phosphate buffer salt solution containing N-acetyl L cysteine) prior to the administration of toxin. Fluid secretion in untreated intestinal loops was also observed if enterotoxin was administered with a live, invasive Salmonella strain which did not evoke a secretory response. A limited survey of Salmonella isolated from clinical and food sources indicated the common occurrence of enterotoxin production, and stock cultures maintained the ability to produce the toxin. The host-adapted species which were tested varied in their ability to produce enterotoxin. AS

40

Thermal inactivation of Clostridium perfringens enterotoxin.

Naik, H. S.; Duncan, C. L.

Journal of Food Protection 41 (2) 100-103 (1978) [15 ref. En] [Food Res. Inst., Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

Thermal inactivation studies of C. perfringens enterotoxin revealed that biological activity was destroyed within 5 min at 60° C, whereas about 10% or less residual serological activity could be detected even after 80 min of exposure at 60° C in saline or in phosphate buffer, pH 7.0 or 8.0. Loss of serological activity was more rapid at 60° C at pH 5.4 or 6.0 than at pH 7.0 or 8.0. Flocculation of enterotoxin was visible in phosphate buffer after 20 min of exposure at 60° C, pH 5.4, 70 min at pH 6.0 but not at all at pH 7.0 or 8.0. Rapid loss of serological activity also occurred at 60° C in cooked turkey, chicken gravy and beef gravy as well as in 5, 10 and 20% bovine serum albumin and gelatin. < 12% of the heat-inactivated serological activity could be recovered by treating toxin in the food samples with urea for 1 h at room temp. However, serological activity of toxin heated in phosphate buffer could not be reactivated by urea treatment. AS

41

Double-antibody radioimmunoassay for staphylococcal enterotoxins A and B.

Robern, H.; Gleeson, T. M.; Szabo, R. A.

Canadian Journal of Microbiology 24 (4) 436-439 (1978) [12 ref. En, fr] [Food Res. Lab., Dep. of

Health & Welfare, Ottawa, Ontario, Canada]

A sensitive double-antibody radioimmunoassay for staphylococcal enterotoxins A and B is described. The separation of the primary antigen-antibody complex of enterotoxin A and B was achieved with an anti-rabbit γ globulin from goats. Radioiodinated aggregate fractions of staphylococcal enterotoxins exhibited reduced immunological activity and showed little competition with non-radioactive enterotoxin. The radioimmunoassay was successfully applied for the quantitation of enterotoxins in food. AS

42

Enterotoxigenic staphylococci in milk.
Pandurangarao, C. C.
Indian Journal of Microbiology 17 (3) 105-107 (1977) [19 ref. En] [Indian Vet. Res. Inst., Izatnagar, Uttar Pradesh, India]

Bovine milk samples (234) collected from Bareilly and Izatnagar areas of Uttar Pradesh (India) were examined for enterotoxigenic staphylococci. Of these, 19 contained coagulase positive staphylococci, 7 of them being enterotoxigenic. Strains producing type C enterotoxin preponderated over others; strains producing type D and type E enterotoxins are the first to be reported from India. CFTRI

43

Incidence of Clostridium perfringens in food of animal origin.
Kanzaki, M.; Kokubo, Y.; Jinbo, K.; Murakami, H.; Haruta, M.
Annual Report of Tokyo Metropolitan Research Laboratory of Public Health 27 (1) 136-140 (1976) [9 ref. En, ja] [Tokyo Metropolitan Res. Lab. of Public Health, 24-1, Hyakumincho 3 chome, Shinjuku-ku, Tokyo 160, Japan]

The numbers of presumptive C. perfringens in fish-pastes, meat and meat products were determined for 1974/1975. Products having a contamination level $\geq 10^2$ organisms/100 g were: raw fish paste, 15 of 62 samples (24.2%); finished protein fish-paste foods, 6 of 197 samples (3.0%); raw meat, 49 of 80 samples (61.3%); and meat products, 250 of 695 samples (36.0%). Sausages were more heavily contaminated than other meat products; 190 of 301 Vienna sausage samples had $\geq 10^2$ presumptive C. perfringens/100 g. Strains of presumptive C. perfringens isolated were subjected to heat resistance tests. 21.4% of isolates from meat products and 2.8% of those from raw meat survived a temp. of 100°C for 10 min. None of the isolates from fish-pastes or fish-paste products survived this treatment. Serotyping of the total of 163 isolates was attempted; 15 isolates could be classified as 11 known serotypes, 13 being from meat and meat products. DIH

44

Enhancement of synthesis of Bacillus cereus enterotoxin using a sac-culture technique.
Parker, D. A.; Goepfert, J. M.
Journal of Food Protection 41 (2) 116-117 (1978) [7 ref. En] [Food Res. Inst., Univ. of Wisconsin, 1925 Willow Drive, Madison, Wisconsin 53706, USA]

A method is described for the production of B. cereus enterotoxin by growing cells in a small vol. of buffer in contact with a large vol. of complex medium which is confined by a dialysis membrane. Highest yields were obtained by using brain-heart infusion medium in the dialysis sac at double strength. Yields of enterotoxin and of cells were higher than with shake-flask control cultures, and it appeared that high mol. wt. components of the growth medium reduced cell growth in the shake flask cultures. The sac-culture technique simplifies purification of toxin as enterotoxin cannot enter the sac and high mol. wt. components of the medium cannot leave it. 3 other extracellular proteins, lecithinase, heat labile haemolysin and heat stable haemolysin were studied; only the synthesis of lecithinase was increased by using the sac-culture method. DIH

45

[Improved regimes for the preservation of sweet red pepper pods.]
Grishina, E.; Skoropad, F. I.; Malkina, E. M.
Konservnaya i Ovoshchesushil'naya Promyshlennost' No. 9, 19-20 (1977) [Ru]

Sterilization processes used for the production of canned products containing sweet red peppers were tested at the Moldavian Research Institute of Food Industry, particularly with respect to the survival of Clostridium botulinum and other anaerobes. The canned products were inoculated with spores of Cl. botulinum and sterilized using various methods. Sterilization of 5 different products with pH 4.1-4.7 at 112-120°C (different time combinations) are given in a table. Incidence of Cl. botulinum ranged from 0 (in a red pepper sauce) to 100% (in sliced red peppers with rice and vegetables in tomato sauce). In the following batch the same products with pH 4.3-4.6 were all sterilized at 120°C (different time combinations). Cl. botulinum was not present in any of the samples tested. New sterilization regulations are given as well as testing procedure. The new sterilization rules did not affect the sensory properties of the products. STI

46

[Bacteriology of dried dairy products - pathogenic bacteria.]
Chopin, A.
Technique Laitiere No. 912, 53-55 (1977) [Fr]

Dried milk products are rarely a cause of foodborne infection, and staphylococci and salmonellae are the only pathogens to date that have been incriminated in cases of food poisoning

traced to dried milk products. This paper contains brief sections on: problems of rehydration of bacteria; selective enumeration of bacteria that have survived the drying process; detection of staphylococcal enterotoxins; and the effects of technological processes (heating, concentration, drying, cooling, instantizing) and storage on pathogenic microorganisms. CDP

47

[Incidence and significance of bacteria belonging to the Clostridium genus observed by complementary bacteriological examinations of meat.]
Takacs, J.; Imreh, E. Z.
Magyar Allatorvosok Lapja 32 (6) 361-363 (1977) [15 ref. Hu, en, ru, de]

Septicaemia, due to clostridia as primary agent, and secondary clostridial infections were diagnosed by complementary bacteriological examinations of meat in 285 healthy animals killed in the usual way and 291 cases of emergency slaughter (4.57 and 4.67% resp. of 6228 animals slaughtered over the period 1970-1975). On the basis of the pathological picture it was established that clostridial infections were related mainly to cases such as difficulty in delivery, endometritis, perforation of reticulum, peritonitis, pneumonia and pleuritis. But is was also often seen in cases of nephritis, kidney degeneration, hepatitis and hepatosis. These examinations draw attention to the fact that special methods for the isolation of clostridia (semifluid sulphite agar, egg yolk agar plate containing D-cycloserine bitartrate) should be used in each case when gross lesions of some importance are found from the point of view of meat control. AS

48

Enterotoxigenicity among salmonellae - a prospective analysis for a surveillance programme.
Kühn, H.; Tschäpe, H.; Rische, H.
Zentralblatt für Bakteriologie, Parasitenkunde, Infektionskrankheiten und Hygiene, IA 240 (2) 171-183 (1978) [31 ref. En, de] [Inst. für Experimentelle Epidemiologie, Burgstrasse 37, Wernigerode, German Democratic Republic]

Attempts to characterize 378 Salmonella strains according to their enterotoxigenicity by means of the vascular permeability factor (PF) are summarized, with reference to food poisoning strains. PF-positive strains are common among all Enteritis-Salmonellae, in particular among S. typhimurium. This serotype is also found with the strongest PF activity. PF-positive strains are found to be active producers of exo-enterotoxins, which have been characterized as LT-enterotoxins (similar to heat-labile Escherichicia coli enterotoxins) by other assays. Since the capacity of Enteritis-Salmonellae to produce enterotoxins is in accordance with their clinical and epidemiological importance, the detn. of the PF-factor as a rapid screening assay for enterotoxigenicity is proposed in this paper in order to survey epidemiologically and clinically significant Salmonellae. AS

49

Heat inactivation of botulinum toxin type A in some convenience foods after frozen storage.
Woolford, A. L.; Schantz, E. J.; Woodburn, M. J.
Journal of Food Science 43 (2) 622-624 (1978) [12 ref. En] [Food Res. Inst., Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

Crystalline type A toxin from the Hall Strain of Clostridium botulinum was added to beef pie fillings (pH 5.9), 0.05M phosphate buffer (pH 5.9), cream of mushroom soup (pH 6.2) or tomato soup (pH 4.1), and 1 ml of each food was placed in 2-ml thin glass ampoules. These were frozen and stored at -20°C for 180 days. At timed intervals a few ampoules were thawed and the contents were tested for toxicity and for the rate of heat inactivation of the toxin. The toxicity of type A in the contents remained the same throughout the frozen storage. Although the literature reports show a decrease in the heat stability of type E toxin after frozen storage, the heat inactivation rates for type A remained the same. pH is one of the important variables affecting the heat stability of type A toxin dissolved in various buffers. IFT

50

[Clostridium perfringens as a food poisoning organism and its detection in foods.] [Review]
Pajulahti, H.
Suomen Eläinlääkärilehti 83 (9) 377-379, 382-383 (1977) [32 ref. Fi, en]

Properties of C. perfringens as a food poisoning organism, and its detection and occurrence in foods are reviewed. Special attention is paid to recent methodology of isolation of C. perfringens from food samples. AS

51

The use of polyethylene glycol in radioimmunoassay of staphylococcal enterotoxins.
Robern, H.; Gleeson, T. M.
Canadian Journal of Microbiology 24 (6) 765-766 (1978) [6 ref. En] [Food Res. Lab., Bureau of Microbial Hazards, Health Protection Branch, Dep. of Health and Welfare, Ottawa, Ontario, Canada]

A single and effective method of precipitating the double-antibody complex of staphylococcal enterotoxins using polyethylene glycol 6000 (PEG) is reported. The double-antibody radioimmunoassay (RIA) of enterotoxins A (SEA), B (SEB) and C (SEC) was modified by the addition of aqueous PEG which precipitated double-antibody bound staphylococcal enterotoxins with little or no precipitation of free enterotoxin. The precipitate formed appeared as a thin coating at the bottom of the test tube and was not removed by aspiration. The procedure obviates the need for normal rabbit serum and for additional wash of the precipitate. Tests of recoveries of enterotoxins from extracts of spiked fermented sausages using PEG in RIA, showed averages of 84, 96 and 100% recovery for SEA, SEC and SEB, resp. SP

52

[Studies on the microbiological quality of mammary gland tissue.]

Staal, J. P. W. M.; Mol, H.; Demmers, W. A. M.; Vincentie, H. M.

Tijdschrift voor Diergeneeskunde 103 (5) 268-272 (1978) [16 ref. Nl, en] [Keuringsdienst von Waren, Utrecht, Netherlands]

239 bovine udders from slaughtered cows were examined for microbiological quality by detn. of counts of total aerobes, anaerobes, Enterobacteriaceae, coliforms, coagulase-positive and DNAase-positive staphylococci, and presence or absence of Salmonellae, Escherichia coli and haemolytic streptococci. Enterobacteriaceae were identified. Tabulated results showed considerable numbers of pathogens and high average counts: e.g. only 33% of samples had $< 10^5$ aerobes/g by blood plate or 52% by plate count agar method, 41% had $< 10^5$ anaerobes/g; 41% contained Enterobacteriaceae, 32% contained coliforms, and 16.7% haemolytic streptococci. 3 samples contained E. coli, 1 Salmonella brandenburg, and 3 Salm. dublin. Results suggested that mammary gland tissue was not acceptable for processing into raw meat products, and the risk of staphylococcal toxin food poisoning could not be excluded in heated products. RM

53

Methods for the microbiological examination of food. II. Examination for specific organisms.

Australia, Standards Association of Australia

***Australian Standard* Addendum No 1 (June 1976) to AS 1766, Part 2-1976**, 8pp. (1976) [En] [80 Arthur Street, N. Sydney, NSW, Australia]

This addendum gives reference procedures for detection and enumeration of Bacillus cereus in foods (on a selective medium containing egg yolk and mannitol), and detection and confirmation of Clostridium botulinum and its toxins in food and culture supernatants (using test animals). [See FSTA (1977) 9 9U558 for AS 1766, Part 2-1976.] AL

54

Incidence of enterotoxigenic Clostridium perfringens in healthy humans in relation to the enhancement of enterotoxin production by heat treatment.

Uemura, T.

Journal of Applied Bacteriology 44 (3) 411-419 (1978) [14 ref. En] [Coll. of Agric., Univ. of Osaka Prefecture, 804 Mozu Ume-machi 4-cho, Sakai, Osaka 591, Japan]

Enterotoxin production was greatly enhanced in 2 of 5 food poisoning strains of Clostridium perfringens subjected to heat treatment prior to incubation in Duncan & Strong sporulation medium. Heating was carried out on 3 successive cultures of each strain, the optimum temp. for treatment being 85°C for 1 strain and 95°C for another; on each occasion cultures were heated for 20 min. The triple heat treatment procedure was used in testing strains of Cl. perfringens isolated from faeces of healthy human subjects for production of enterotoxin. 11 of 35 (31%) individuals were found to be carriers of enterotoxigenic strains, the isolates producing > 0.1 µg/ml of enterotoxin. 6 of the 11 enterotoxigenic strains were killed by heating at 95°C but 1 isolate produced more enterotoxin following treatment at this temp. than after heating at 75°C. AS

55

Effect of beef broth protein on the thermal inactivation of Staphylococcal enterotoxin B.

Lee, I. C.; Stevenson, K. E.; Harmon, L. G.

Applied and Environmental Microbiology 33 (2) 341-344 (1977) [9 ref. En] [Dep. of Food Sci. & Human Nutr., Michigan State Univ., East Lansing, Michigan 48824, USA]

Enterotoxin B produced by Staphylococcus aureus 243 in brain heart infusion broth was concentrated by dialysis against 40% polyethylene glycol (20M), partially purified on a Sephadex G-100 column and heated at 110°C in thermal death time cans. Various heating menstrua included 0.04M Veronal buffer (pH 7.4), beef broth, and fractions of beef broth obtained by ultrafiltration or precipitation with ammonium sulphate. The toxin was assayed serologically using the microslide gel double-diffusion method. The time required for 90% inactivation at 110°C (D_{110} value) obtained in buffer and in beef broth was 18 and 60 min, resp. When the concn. of beef broth was increased 5-fold, the D_{110} increased to 78 min. The apparent protective effect of protein was further investigated using beef broth protein obtained by precipitation with $(NH_4)_2SO_4$. The D_{110} values were 51 and 70 min when the protein concn. in the heating menstruum was 3.8 and 7.7 mg/ml, resp. However, when the beef broth protein was dialysed against buffer before use as a heating menstruum, the D_{110} was only 39 or 41 min at comparable protein concn. Results indicated a dialysable factor, whose protective effect was partially destroyed by trypsin and chymotrypsin but not by disodium ethylenediaminetetraacetate, was involved in the protection of enterotoxin B during heating. AS

56

[Botulism resulting from home-preserved stewed pork.]

Dolzhevik, N. Ya.; Lyubarets, I. M.; Tkachenko, V. P.

Gigiena i Sanitariya No. 6, 93-94 (1978) [Ru] [Chernigovskaya Oblastnaya i Raionnaya Sanepidstantsiya, Chernigov, USSR]

A case is described of botulism (Type B toxin), caused by eating home-stewed pork. During the preparation, the pork had been inadequately washed, cooked in the oven, placed into open cans after cooling (without a second heat treatment), the

cans covered with polyethylene lids, and stored in a domestic refrigerator. HBr

57

Identification of enterotoxigenic staphylococci from sheep and sheep cheese.
Hajek, V.
Applied and Environmental Microbiology 35 (2) 264-268 (1978) [28 ref. En] [Dep. of Microbiol., School of Med., Palacky Univ., 775 15 Olomouc, Czechoslovakia]

Of 83 Staphylococcus aureus strains from healthy and mastitic ewes and 44 from ewes' milk cheese, 77 and 37 resp. were biotype C and 3 and 6 were biotype A. In phage-typing experiments, the majority of isolates showed sensitivity to Davidson's phage 78. 3 biotype C isolates showed biochemical characteristics and phage sensitivities typical of species of bovine origin. Enterotoxin C was produced by 46 and 6 biotype C strains from ewes and cheese resp., and enterotoxin D correspondingly by 3 and 1 biotype A strains; enterotoxin A was produced by 2 unclassifiable strains from ewes and 1 biotype C strain from cheese. It is concluded that enterotoxigenic staphylococci present in ewes' milk are able to survive the cheesemaking process. CDP

58

Enterotoxins of staphylococci in foodstuffs.
Müller, F. J.
XX International Dairy Congress E, 346 (1978) [6 ref. En] [Lab. ENTEROTOX, Krefeld, Federal Republic of Germany]

The enterotoxin types most frequently found amongst staphylococci isolated from various foods were A and D, alone or in combination with other toxin types. Enterotoxic staphylococci were generally of phage group III, IV or M. The milk product in which enterotoxins occurred most frequently was cheese; they were found also in evaporated milk, dried milk, ice cream and infant formulae. [See FSTA (1978) **10** 10P1408.] CDP

59

The number of enterotoxigenic Staphylococcus aureus in 24-hour old Gouda cheese made under optimal manufacturing conditions and the amount of enterotoxin produced.
Foeken, A. W. J. van; Stadhouders, J.; Witsenburg, W. W.
XX International Dairy Congress E, 774-775 (1978) [4 ref. En] [Netherlands Inst. for Dairy Res. (NIZO), Ede, Netherlands]

In Gouda cheese made under optimum conditions, enterotoxin could always be detected when the Staph. aureus count exceeded 10^8/g; levels of enterotoxin ranged from 0.5 to 2.0 μg/100 g cheese. Strains differed in the amount of enterotoxin produced. [See FSTA (1978) **10** 10P1408.] CDP

60

The thermonuclease test for assessment of the growth of coagulase-positive staphylococci in cheese.
Foeken, A. W. J. van; Stadhouders, J.
XX International Dairy Congress E, 344 (1978) [5 ref. En] [Netherlands Inst. for Dairy Res., (NIZO), Ede, Netherlands]

A modified procedure for detection of DNAase in cheese was able to detect quantitatively 1 μg DNAase/20 g cheese. The test gave positive results when $\geq 10^6$ Staphylococcus aureus/g was present in 24-h-old cheese. [See FSTA (1978) **10** 10P1408.] CDP

61

Growth of enterotoxigenic Staphylococcus aureus in concentrated milk.
Ghodekar, D. R.; Batish, V. K.; Nambudripad, V. K. N.
XX International Dairy Congress E, 743-744 (1978) [En] [Nat. Dairy Res. Inst., Karnal, India]

During vacuum concentration in a rotary film evaporator at 40° and 45°C, Staph. aureus counts in artificially contaminated reconstituted dried skim-milk increased about 100-fold after 5 h. The staphylococci were able to produce toxins in concentrated milk, and also showed a tendency to produce variants. [See FSTA (1978) **10** 10P1408.] CDP

62

[Incidence of Escherichia coli in raw oyster and enterotoxin producibility of the isolates.]
Kokubo, Y.; Matsushita, S.; Kai, A.; Yamada, M.; Konuma, H.
Journal of the Food Hygienic Society of Japan [Shokuhin Eiseigaku Zasshi] 19 (1) 117-121 (1978) [12 ref. Ja, en] [Tokyo Metropolitan Res. Lab. Public Health, Hyakunincho 3-chome, Shinjuku-ku, Tokyo, Japan]

During the period from Oct. 1976 to Mar. 1977, a total of 405 raw oyster samples mainly obtained at Tokyo Central Wholesale Market were analysed for the presence of E. coli by a standard simplified multiple test tube technique with EC broth. There were 229 positive samples (56.5%). Among the 138 isolates tested for their producibility of enterotoxin, 4 strains were positive. One strain was a producer of only heat-labile enterotoxin, while the other 3 strains were producers of only heat-stable enterotoxin. TM

63

Evaluation of the API and Minitek systems for the biochemical identification of clostridia.
Ali-Yrkkö, S.; Karppinen, A.; Korhonen, H.
XX International Dairy Congress E, 342-343 (1978) [2 ref. En] [Inst. of Dairy Sci., Univ. of Helsinki, Helsinki, Finland]

The API and Minitek systems were relatively simple and fast methods, showing 85.2 and 91.5% agreement resp. with conventional methods for identifying clostridia. The Minitek micromethod had the advantage that individual tests could be selected as needed, but additional tests were necessary when unknown clostridia were to be identified. [See FSTA (1978) **10** 10P1408.] CDP

64

[Clostridium botulinum Symposium, held at Göteborg, Sweden, 8 April 1976.] [Conference proceedings]
Sweden, SIK-Svenska Livsmedelsinstitutet
SIK Rapport No. 410, 94pp. ISBN 91-7290-047-4 (1976) [many ref. Sv]

The full text is given of papers presented at this symposium, including the following: The biological mechanism of the action of Botulinum toxin, by H. Lundh (pp. 47-49, 4 ref.); and Clinical aspects of human botulism, by J. Lindberg (pp. 51-63). A further 6 papers are abstracted separately in FSTA, and are in the author index under **Sweden**, SIK-Svenska Livsmedelsinstitutet [Clostridium botulinum Symposium]. AJDW

65

Effect of low-dose gamma irradiation on enterotoxin-positive strains of Clostridium perfringens Type A.
Barnhart, H. M., Jr.
Dissertation Abstracts International, B 37 (7) 3331: Order No. 77-897, 105pp. (1977) [En] [Univ. of Nebraska, Lincoln, Nebraska 68503, USA]

The effects of γ-irradiation on C. perfringens strains NCTC-8239, NCTC-10239 and NCTC-8798 were determined in (i) 0.1% peptone water or (ii) beef gravy or ground beef. D_{10} values for vegetative cells were in (i) and (ii), 30 and 175 krad, resp. D_{10} values for spores in (i) and (ii) were 250 and 335 krad, resp. A lag time of approx. 2 h (depending on strain) was induced in recovery at 37° C after low-dose irradiation. Heat resistance of 2 strains was decreased by irradiation. Low dose irradiation did not affect spore activation or germination, survival of vegetative cells stored at low temp., or enterotoxin production. Affinity chromatography techniques were used to purify enterotoxin, and a crossed-immunoelectrophoresis method for detection of enterotoxin was developed, which was sensitive to <0.05 g enterotoxin in crude preparations. DIH

66

[Detection of Clostridium botulinum and its toxin in foods.] [Lecture]
Abrahamsson, K.
SIK Rapport No. 410, 15-30 (1976) [18 ref. Sv] [Mjolkcentralen Arla, Stockholm, Sweden]

After a discussion of the geographical and ecological distribution of Clostridium botulinum and of outbreaks of botulism in the USA, methods for detection of Cl. botulinum and its toxin are briefly described. Aspects considered include: achievement of anaerobic culture conditions; enrichment media; incubation temp.; isolation methods; the morphology of Cl. botulinum colonies; and methods for identification of botulinum toxin (the mouse test or fluorescent antibody techniques). [See FSTA (1978) **10** 12C452.] AJDW

67

Immunological determination of botulinum toxins. [Lecture]
Uemura, T.
SIK Rapport No. 410, 31-37 (1976) [11 ref. En] [Norwegian Food Res. Inst., PO Box 50, N-1432 Aas- NLH, Norway]

Detection of Clostridium botulinum toxin by the reversed passive haemagglutination test is discussed, with reference to: sensitivity; specificity, and cross reactions between toxin types; molecular aspects of specificity, in relation to the serological activity of botulinum progenitor toxin, derivative toxin and the atoxic component formed on release of the derivative toxin from the progenitor toxin; interference by food constituents; and standardization of the method, with special reference to the preparation, standardization and shelf-life of sensitized formalin-treated sheep red blood cells. [See FSTA (1978) **10** 12C452.] AJDW

68

Staphylococcus aureus growth and enterotoxin production in soy proteins and soy-supplemented meats.
Craven, S. E.; Blankenship, L. C.; Mercuri, A. J.
Abstracts of the Annual Meeting of the American Society for Microbiology 77, 257 (1977) [En] [USDA, Athens, Georgia, USA]

S. aureus S-6 growth and enterotoxin A and B (SEA, SEB) production were determined in ground beef and pork sausage supplemented with 20% (w/w) hydrated soy proteins and in isolated soy protein (ISP), soy protein concentrate (SPC), and textured soy protein (TSP) adjusted to 20% protein with dextrose-salts medium. Meat and meat-soy samples were heated to 71° C prior to inoculation and storage at 37° C. Growth was followed by plating on Brain-Heart-Infusion agar and Vojel-Johnson agar. Enterotoxins were detected by the method of Reiser et al. [see FSTA (1974) 6 8C294] after 12-72 h sample storage. Generation times in meat-soy samples were not significantly different from those in meat alone. Growth of S. aureus in ISP, SPC, and TSP in dextrose-salts medium was comparable to growth in meat alone. SEB production was similar in beef, beef + ISP, pork, pork + ISP, pork + SPC and pork + TSP. Lower amounts were observed in beef + SPC, beef + TSP, ISP and TSP alone. No SEB was detected in SPC alone. SEA production was similar in meat

and meat-soy samples except beef + SPC where SEA levels were reduced. SEA was detected in low levels in ISP and TSP alone but not in SPC alone. These findings suggest that addition of soy proteins to beef and pork does not increase the risk of S. aureus food poisoning. AS

69

[Is biochemistry able to show the mechanisms of toxicity of toxic substances present in foods?] [Review]
Lowy, R.; Manchon, P.
Cahiers de Nutrition et de Dietetique 13 (2) 137-146 (1978) [6 ref. Fr, en]

70

[Botulism, a little-known condition.] [Review]
Fameree, L.; Marchal, A.; Cotteleer, C.
Revue Technique des Veterinaires Hygienistes de l'Alimentation 14 (114) 19-22; (115) 29-37 (1975) [65 ref. Fr] [Inst. Nat. de Recherches Vet., Brussels, Belgium]

Aspects discussed in this review on botulism include: frequency of occurrence in various countries; details of 3 clinical cases; Clostridium botulinum and its characteristics; C. botulinum toxin, its formation, stability and antigenic characteristics; epidemiology (with reference to foods commonly implicated); diagnosis; and identification of the toxin. AJDW

71

Comparison of selective media for coagulase-positive enterotoxigenic Staphylococcus aureus.
Niskanen, A.; Aalto, M.
Applied and Environmental Microbiology 35 (6) 1233-1236 (1978) [14 ref. En] [Tech. Res. Cent. of Finland, Food Res. Lab., Biologink. 1, SF-02150 Espoo 15, Finland]

Different culture media were used to detect enterotoxigenic Staphylococcus aureus strains from peptone salt solution and inoculated minced meat. When recovery, reactions, and counting mistakes were considered, it was concluded that Baird-Parker agar was the best medium. AS

72

Rapid qualitative method for detecting staphylococcal nuclease in foods.
Koupal, A.; Deibel, R. H.
Applied and Environmental Microbiology 35 (6) 1193-1197 (1978) [17 ref. En] [Dep. of Bact., Coll. of Agric. & Life Sci., Univ. of Wisconsin, Madison, Wisconsin 53706, USA]

A rapid method for the detection of heat-stable staphylococcal nuclease in foods is described. The procedure consists of an acid precipitation, boiling, and centrifugation followed by enzyme detection in an agar plate containing DNA. To test the efficacy of the procedure, purified Staphylococcus aureus nuclease was added to various foods and recovery experiments were performed. Additionally, foods were inoculated and incubated with Staph. aureus, and the staphylococcal counts were compared with nuclease activity. Results indicate that the procedure is a rapid method that can be incorporated into quality control programmes. The procedure requires approx. 2.5 h, and will detect nuclease levels as low as 10 ng/g food. AS

73

[Heat treatment, pH and preservatives.] [Lecture]
Snygg, B. G.
SIK Rapport No. 410, 83-94 (1976) [Sv] [SIK-Svenska Livsmedelsinst., Göteborg, Sweden]

Methods for control of growth and toxin formation by Clostridium botulinum in foods are discussed, with reference to: thermal sterilization or pasteurization; acidification; salting; chemical preservation, e.g. with nitrite, hexymethylenetetramine, p-hydroxybenzoic acid esters or sorbic acid; reduction of the water activity of the product; and modification of the redox potential. Tables of data are given showing effects of these factors on growth and toxin formation by Cl. botulinum. [See FSTA (1978) 10 12C452]. AJDW

74

[Fermentation as a protection against Clostridium botulinum.] [Lecture]
Lindgren, S.
SIK Rapport No. 410, 65-72 (1976) [7 ref. Sv] [Landbrukshogskolans Mikrobiol. Inst., Uppsala, Sweden]

The potential of bacterial fermentation for control of growth and toxin formation by Clostridium botulinum in foods is discussed, with special reference to lactic fermentation. Aspects considered include: mechanisms of antagonistic activity (competition for nutrients, reduction of the pH, formation of inhibitory substances, and alteration of the redox potential); organisms showing antagonistic activity towards Cl. botulinum (Pseudomonas aeruginosa, Cl. sporogenes, Enterobacteriaceae, Bacillus subtilis, Lactobacillaceae, Streptococcaceae, Brevibacterium linens); and possible practical applications, e.g. inoculation of packaged meat products with lactic acid bacteria. [See FSTA (1978) 10 12C452]. AJDW

75

Thermostable deoxyribonuclease (DNase) as a rapid screening method for the detection of staphylococcal enterotoxin in milk and milk products.
Batish, V. K.; Ghodekar, D. R.; Ranganathan, B.
XX International Dairy Congress E, 345 (1978) [4 ref. En] [Nat. Dairy Res. Inst., Karnal, India]

Thermostable DNAase-producing staphylococci isolated from raw milk, Cheddar cheese and baby food also produced enterotoxin A, whilst those

isolated from dried milk produced enterotoxin A and/or B. Strains that were coagulase-positive but DNAase-negative were considered non-enterotoxigenic. [See FSTA (1978) **10** 10P1408.] CDP

76

[An outbreak of human type B botulism attributable to fermented trout.]
Roed, R. A.; Bjerke, P. E. M.
Norsk Veterinaertidsskrift **90** (1) 19-22 (1978) [12 ref. No] [Norges Veterinaerhogskole, Postboks 8146, Oslo 1, Norway]

Studies on an outbreak of botulism resulting from consumption of trout which had been fermented in brine for 5 months are described. 13 people consumed the trout; 8 suffered botulism, 2 being hospitalized. No fatal cases were recorded. The remaining trout samples and serum samples from the 2 hospitalized patients were examined. Data are given for the mouse toxicity of serum samples from one of the patients, and the botulinum toxin content of the fish. Mice injected with serum from the patients died, showing typical symptoms of botulism. Considerable toxin levels were detected in the remaining fish ($\leq$1000 MLD/g). Serological tests showed the toxin present to be type B. Bacteria isolated from the fish were identified as Clostridium botulinum type B. Methods for minimization of the risk of Cl. botulinum toxin formation in fermented trout are discussed. AJDW

77

[Smoking and cold storage.] [Lecture]
Krogh, G.
SIK Rapport No. 410, 73-82 (1976) [Sv] [Statens Livsmedelsverk, Uppsala, Sweden]

The potential hazard of growth and toxin formation by Clostridium botulinum in smoked fish is discussed with reference to: contamination of the raw material; hot- and cold-smoking, and their efficacy for elimination of clostridia; secondary contamination of smoked fish; factors tending to limit growth and toxin formation by Cl. botulinum in smoked fish (salting, altered pH, water activity and redox potential, inhibitory activity of smoke constituents, and presence of antagonistic organisms); and the need for low-temp. storage and transport to control growth of Cl. botulinum. [See FSTA (1978) **10** 12C452.] AJDW

78

[Clostridium botulinum type E as a problem in fish processing.] [Lecture]
Huss, H. H.
SIK Rapport No. 410, 3-13 (1976) [Da] [Fiskeriministeriets Forsogslab., Danmarks Tekniske Hojskole, Lyngby, Denmark]

Problems with contamination of fish and fish products with Clostridium botulinum (mainly type E) are briefly discussed, with reference to data for the incidence of human botulism in Denmark over the period 1901-1976 (and the foods implicated); the incidence of Cl. botulinum in fish in relation to evisceration, washing, etc.; the incidence of Cl. botuligum in processed fish products of various types; distribution of Cl. botulinum in marine and freshwater environments; and factors influencing the incidence of Cl. botulinum in fish farms. Low-temp. ($<3.5°$C) storage of all non-sterilized fish products is recommended. [See FSTA (1978) **10** 12C452.] AJDW

79

Effect of prior refrigeration on botulinal outgrowth in perishable canned cured meat when temperature abused.
Tompkin, R. B.; Christiansen, L. N.; Shaparis, A. B.
Applied and Environmental Microbiology 35 (5) 863-866 (1978) [9 ref. En] [Swift & Co., Res. & Development Cent., Oak Brook, Illinois 60521, USA]

Perishable canned cured meat inoculated with Clostridium botulinum spores was placed at 4.4° or 10° C after manufacture. Spore germination occurred at 10° C. The germinated cell count remained stable over a period of 16-18 wk. During that time period the inhibitory system and residual nitrite decreased. These factors combine to make perishable canned cured meats more prone to spoilage and potential hazard if they are temp. abused after a period of refrigerated storage. AS

80

Causes of variation in botulinal inhibition in perishable canned cured meat.
Tompkin, R. B.; Christiansen, L. N.; Shaparis, A. B.
Applied and Environmental Microbiology 35 (5) 886-889 (1978) [6 ref. En] [Swift & Co., Res. & Development Cent., Oak Brook, Illinois 60521, USA]

Final internal processing temp. within the range 63-74° C did not alter the degree of botulinal inhibition in inoculated perishable canned comminuted cured pork subjected to abusive storage at 27° C. Adding haemoglobin to the formulation reduced residual nitrite after processing and decreased botulinal inhibition. Different meats yielded different rates of botulinal outgrowth when substituted for fresh pork ham. Pork or beef heart meat showed no inhibition of the Clostridium botulinum inoculum even with a 156-μm/g amount of $NaNO_2$ added to the product. This effect appears to be one of stimulating outgrowth, since residual nitrite depletion was not measurably altered. AS

81

Enterotoxigenic staphylococci in raw meats.
Pandurangarao, C. C.
Journal of Food Science and Technology, India 14 (5) 224-225 (1977) [10 ref. En] [Indian Vet.

Res. Inst., Izatnagar, India]

66 buffalo meat, 55 pork, 12 mutton and 7 chicken meat samples collected from Bareilly market were examined for enterotoxigenic staphylococci. 10% NaCl broth for enrichment followed by surface streaking on ETGPA medium of Baird-Parker was employed for isolation. 18 (27%) buffalo, 14 (25%) pork, 3 mutton and 1 chicken meat samples revealed coagulase positive staphylococci. 5 isolates from buffalo meat, 2 from pork and 1 from mutton were found to be enterotoxigenic. As many as 6 out of 8 enterotoxigenic isolates produced enterotoxin C either alone or in combination with others. Enterotoxigenic staphylococci from buffalo meat, pork and mutton are reported for the first time in India. AS

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